Fuel Cell Presentation For Clean Distributed Generation: Local Siting, Permitting and Code Issues

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Overview

- Fuel Cell Fundamentals & Principles Of Operation
- Fuel Cell Technologies
- Codes & Standards Requirements
- Summary

Fuel Cells Defined

"Fuel Cells are electrochemical devices that convert the chemical energy of reaction directly into electrical energy."

Fuel Cells: A Handbook

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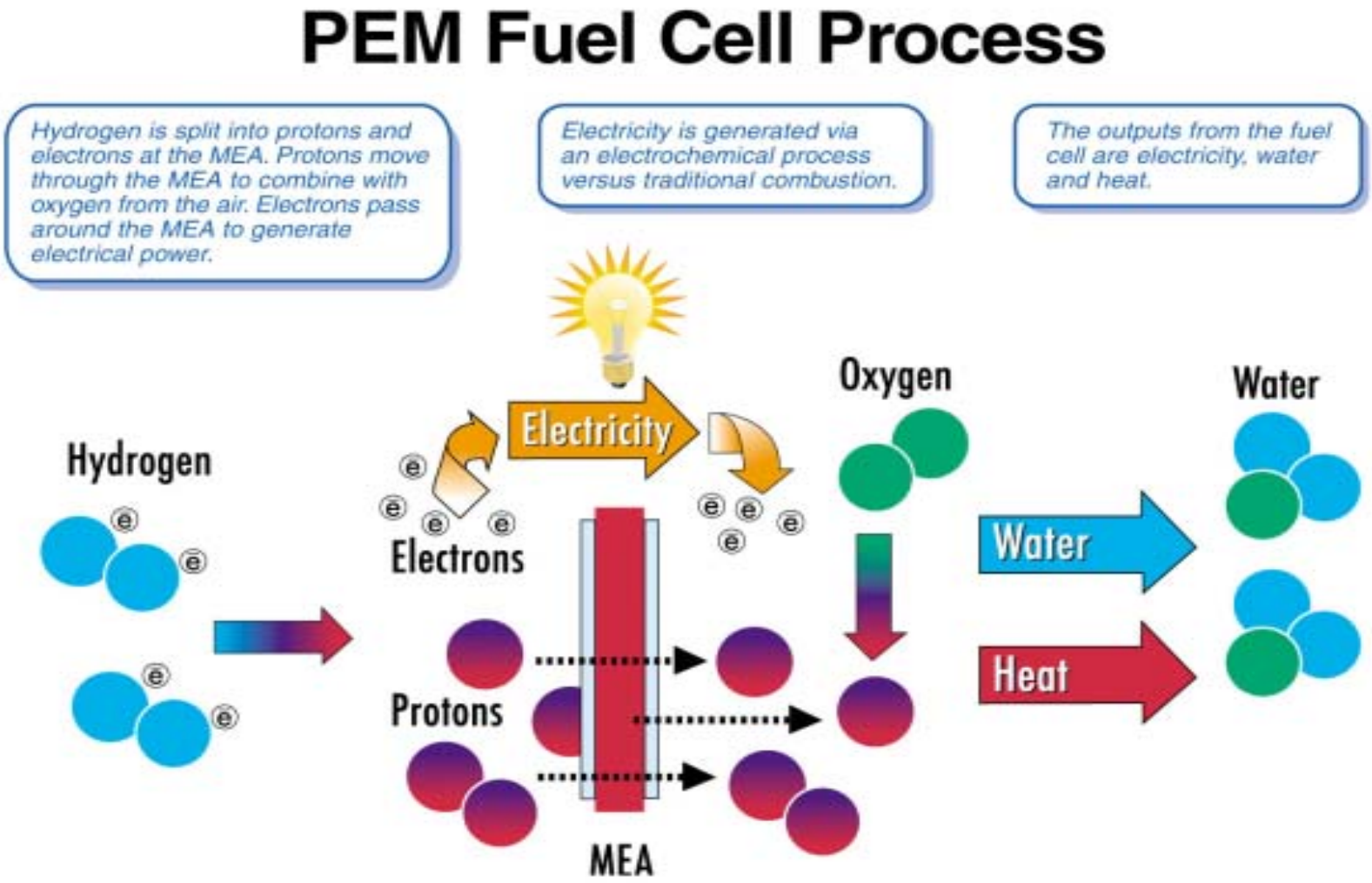
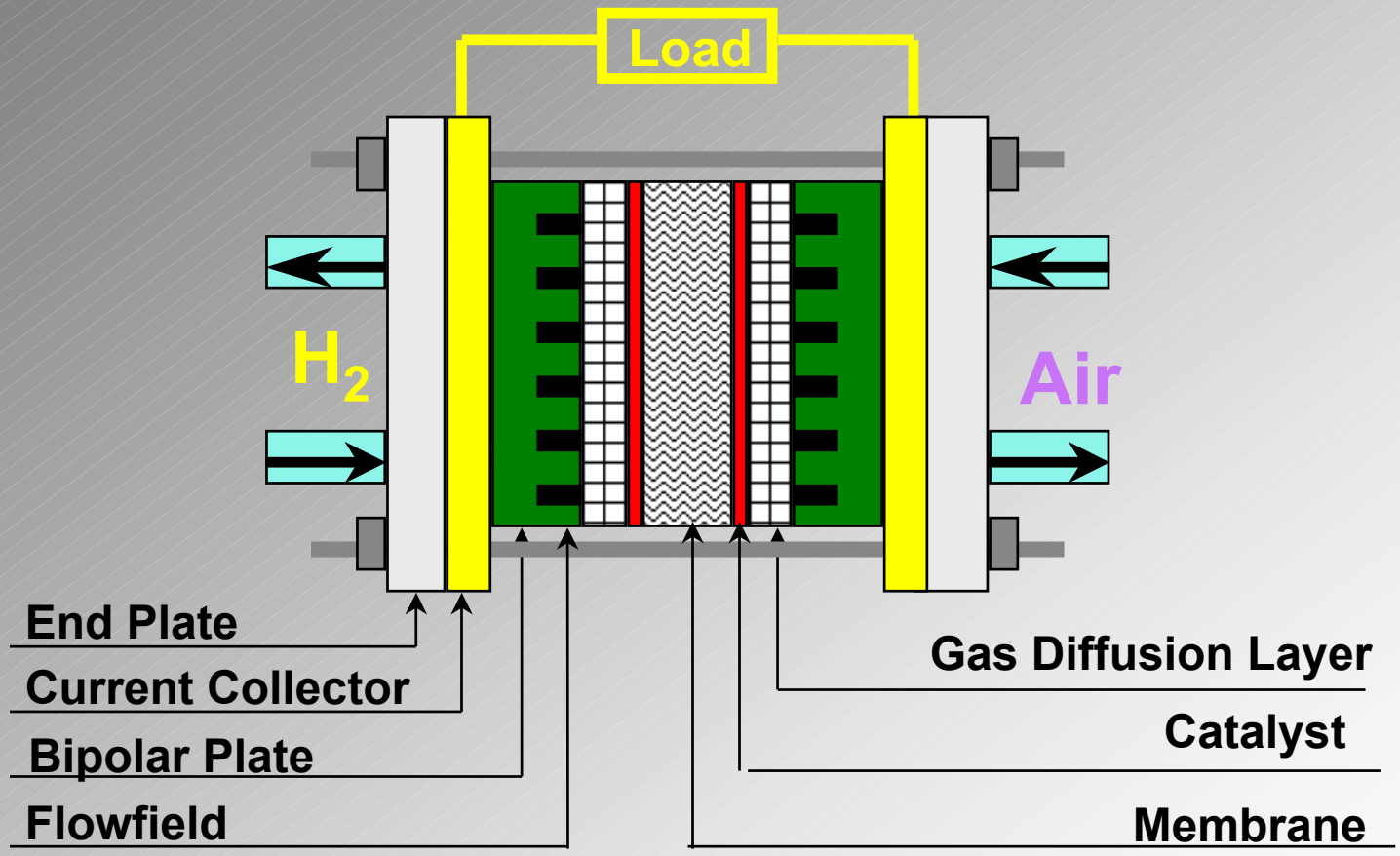
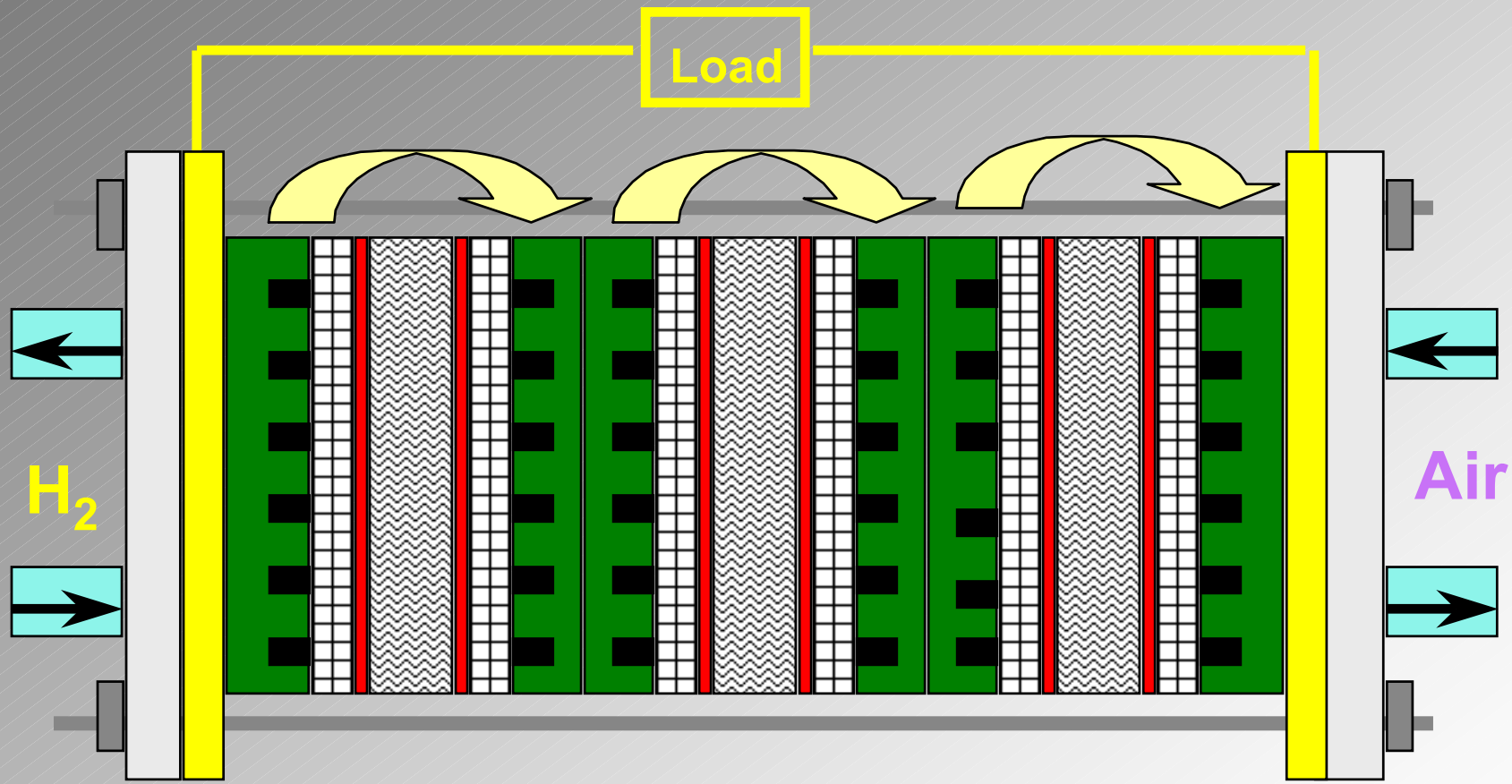
How Fuel Cells Work



Fundamentals of a PEM Fuel Cell

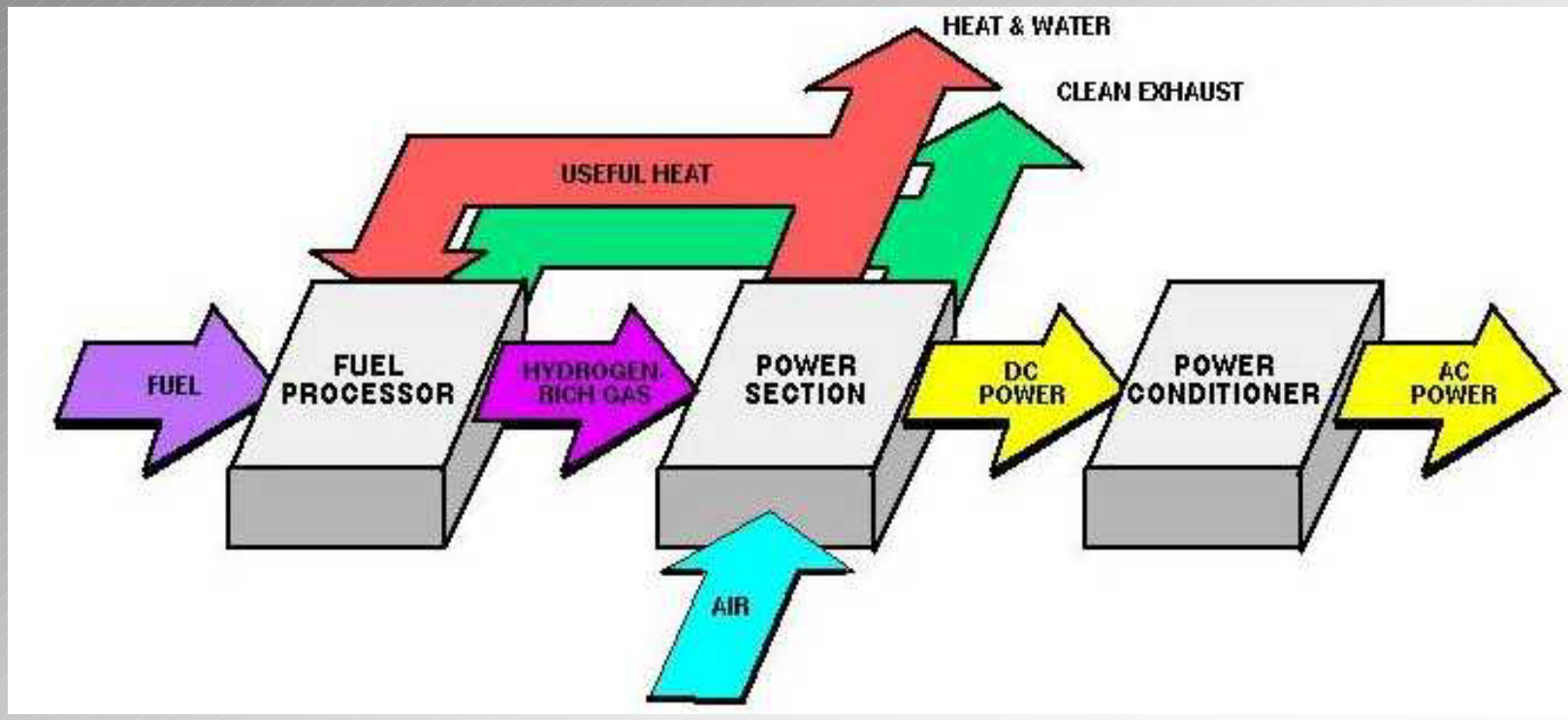


Fuel Cell Stack

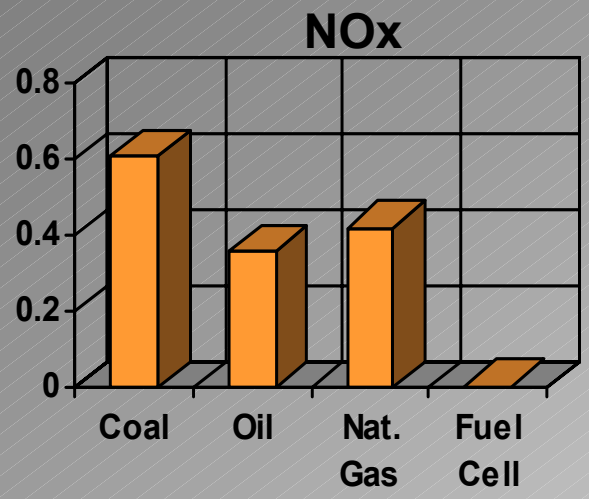


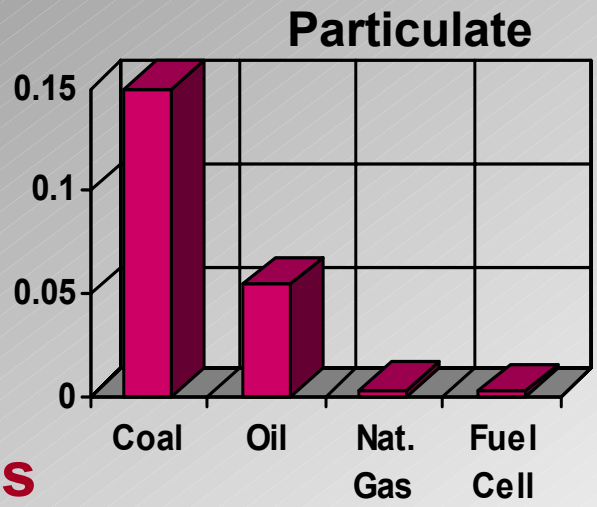
FUEL CELLS - CONCEPT

- FUEL CELL POWER PLANT
  - FUEL CELL STACK
  - FUEL PROCESSING
  - ELECTRIC POWER CONVERSION
  - BALANCE OF PLANT

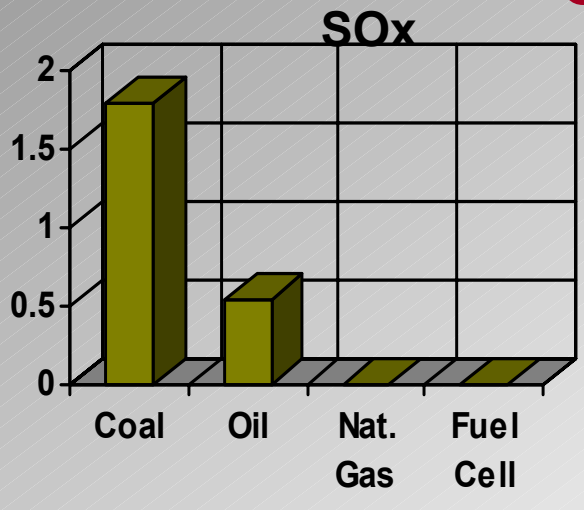


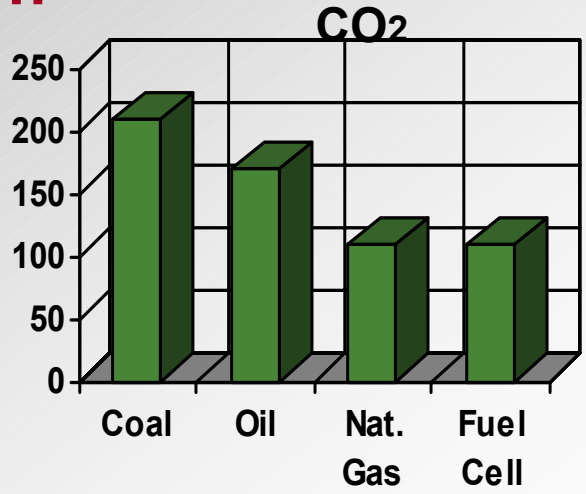
Fuel Cells Are Environmentally Clean





Emissions Comparison





Source: NRDC Reports: Choosing Clean Power, March 1997

FUEL CELL TECHNOLOGIES

Fuel Cell Technology	Electrolyte	Operating Temperature	Efficiency (%)	
			Electrical	Overall
PEMFC	Ion exchange membrane	50 C	30-35	50-60
AFC	KOH	80 C	Low	Low
PAFC	Phosphoric Acid	200 C	36	80
MCFC	Alkali carbonates	650 C	45-55	75-80
SOFC - High Temp.	Solid metal oxide	980 C	45-47	75-80
SOFC - Reduced Temp.	Solid metal oxide	660 C	42-45	60-70

Source: SFCCG, Inc. (Aug. 1997)

Product Requirements

- **ANSI Z21.83** – Fuel Cell Power Plants
  - Applies to fuel cells with an electrical output less than 1MW
- **UL 1741** – UL Standard for Safety for Inverters, Converters, and Controllers for Use in Independent Power Systems

Installation Requirements

- **NFPA 853** – Standard for the Installation of Stationary Fuel Cell Power Plants
  - Current edition applies to systems larger than 50kW only but consideration is being given to expand requirements to cover all fuel cell installations.
- **NFPA 54** – National Fuel Gas Code
- **NFPA 70** – National Electrical Code®
- Codes, Rules, and Regulations of the State of New York
- ICC – International Building Code

Electrical Interconnection Requirements

- NYS Standardized Interconnection Requirements (SIR) for Distributed Resources <300kW On Radial Feeders
- Other State Requirements – Texas, California, Etc.
- **IEEE 929** – Recommended Practice for Utility Interface of Photovoltaic (PV) Systems
  - Applies to installations <10kW

Requirements Under Development

- **ASME Performance Test Code (PTC) 50** – Fuel Cells
- **NFPA 70 – 2002** National Electrical Code® Article 692 – Fuel Cell Systems
- **IEEE 1547** – Standard for Interconnecting Distributed Resources with Electric Power Systems
- **IEC TC105** – IEC (International) Fuel Cell Standard

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The Stationary Fuel Cell System

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